Intelligent Waterways Systems

A CG R&D Investment Area

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Intelligent Waterways Systems

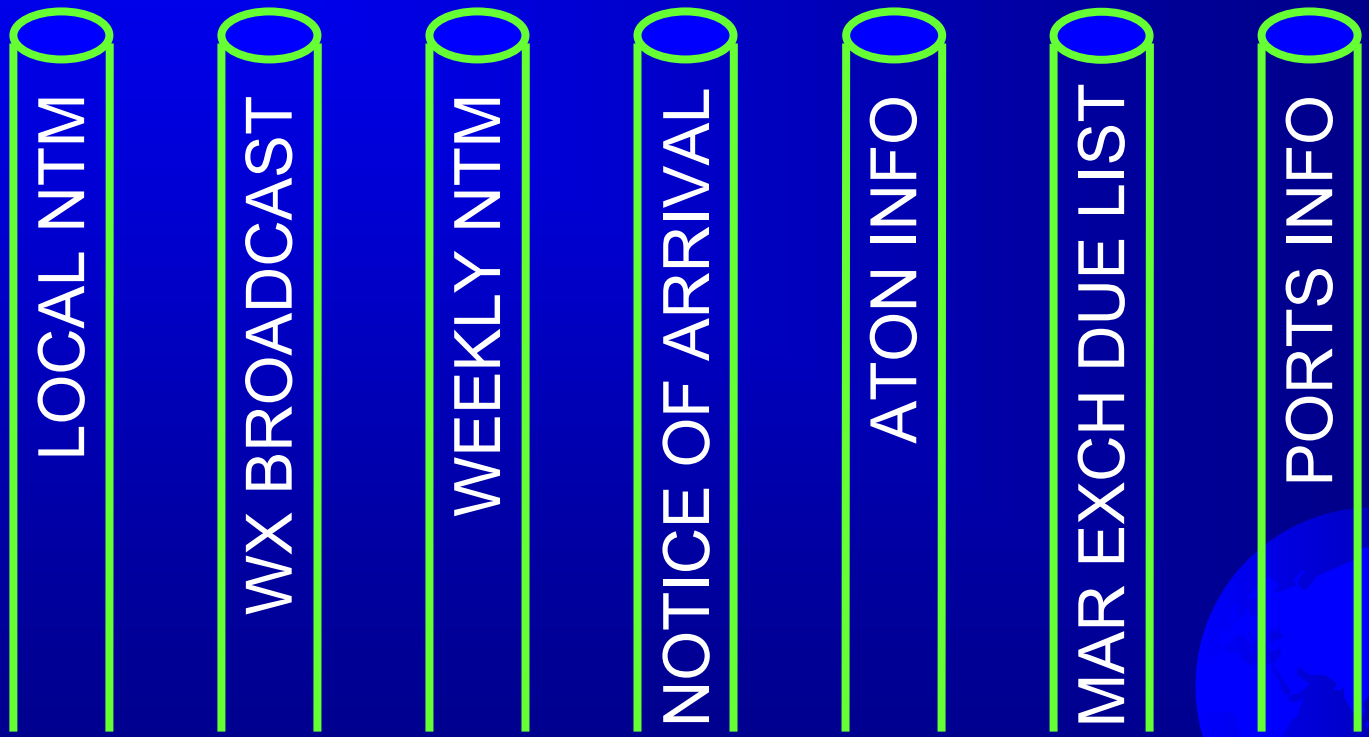
- *IWS- The collection of systems used to convey waterway related information crucial to MTS*
- *IWS R&D Objective*
  - to build a concept, tools and prototype needed to leverage technology to improve security, safety & mobility of the MTS.

IWS Requirements

- Satisfy a diverse user community
  - Government, commercial, military, recreational (home)
- Multiple departments & agencies directly involved
  - Both consumers and providers of the information
- Handle public, proprietary and sensitive information
- Provide security for users and providers

PRESENT INFORMATION FLOW

INFORMATION USERS



INFORMATION PROVIDERS

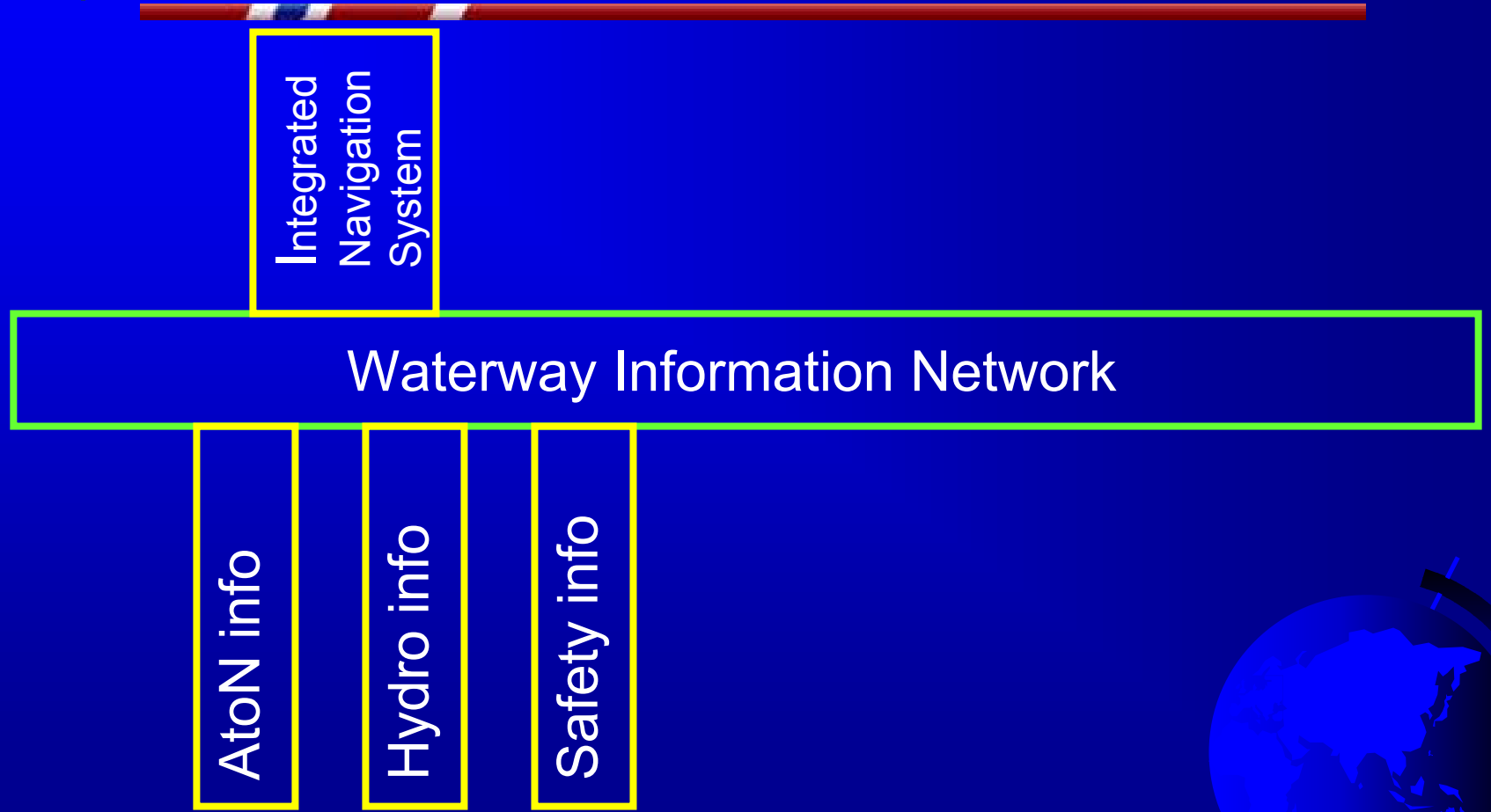
Network Solution

- Waterways Information Network
  - Goal
    - Apply internet technology to solve the problem of distribution of marine navigation and related information.
  - Partnering effort with Arizona State University
    - Funded by NSF digital government program
  - Project is in formulation stage.

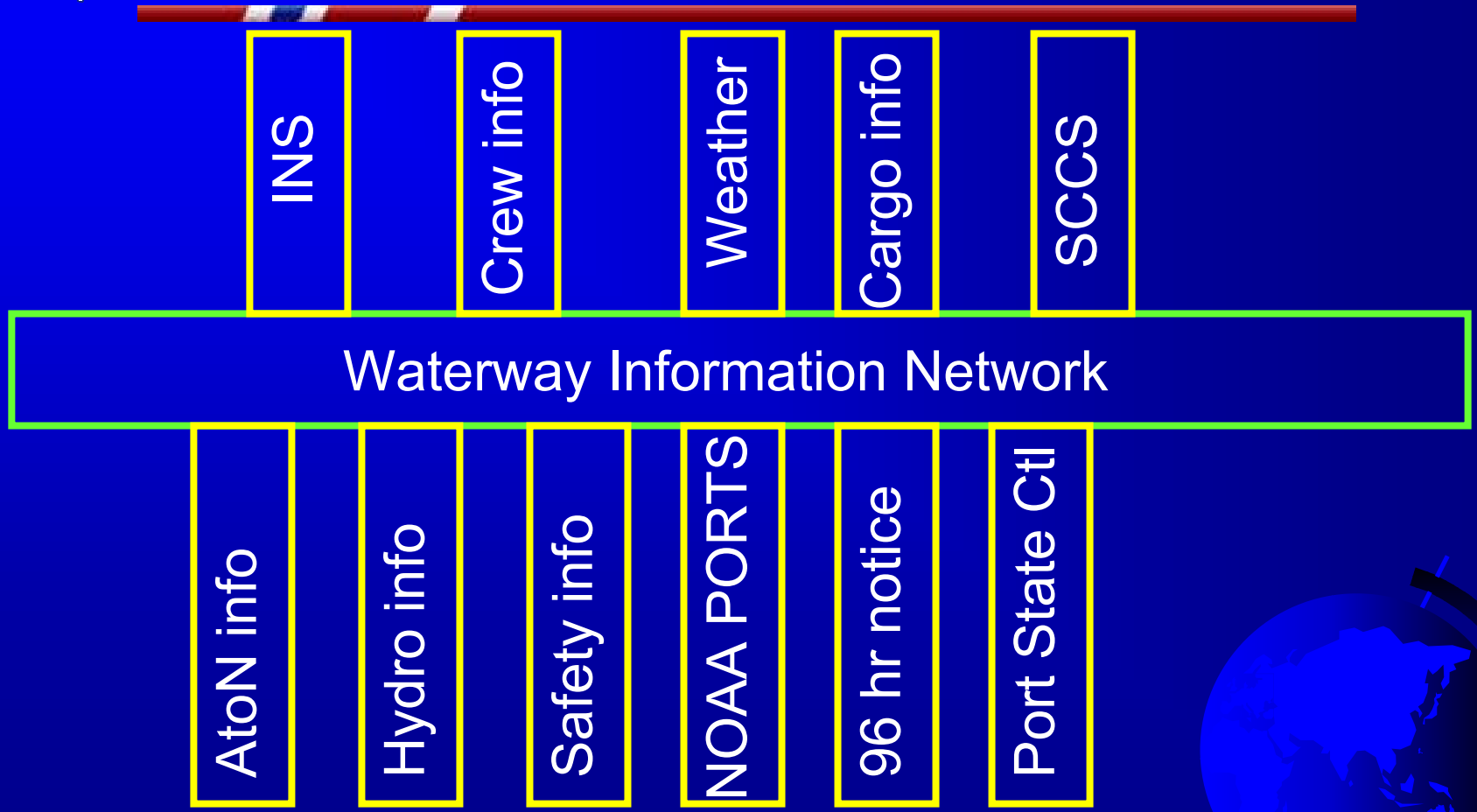
Network Solution

Waterway Information Network – develop protocols, format and means for seamlessly transferring information from providers to users.

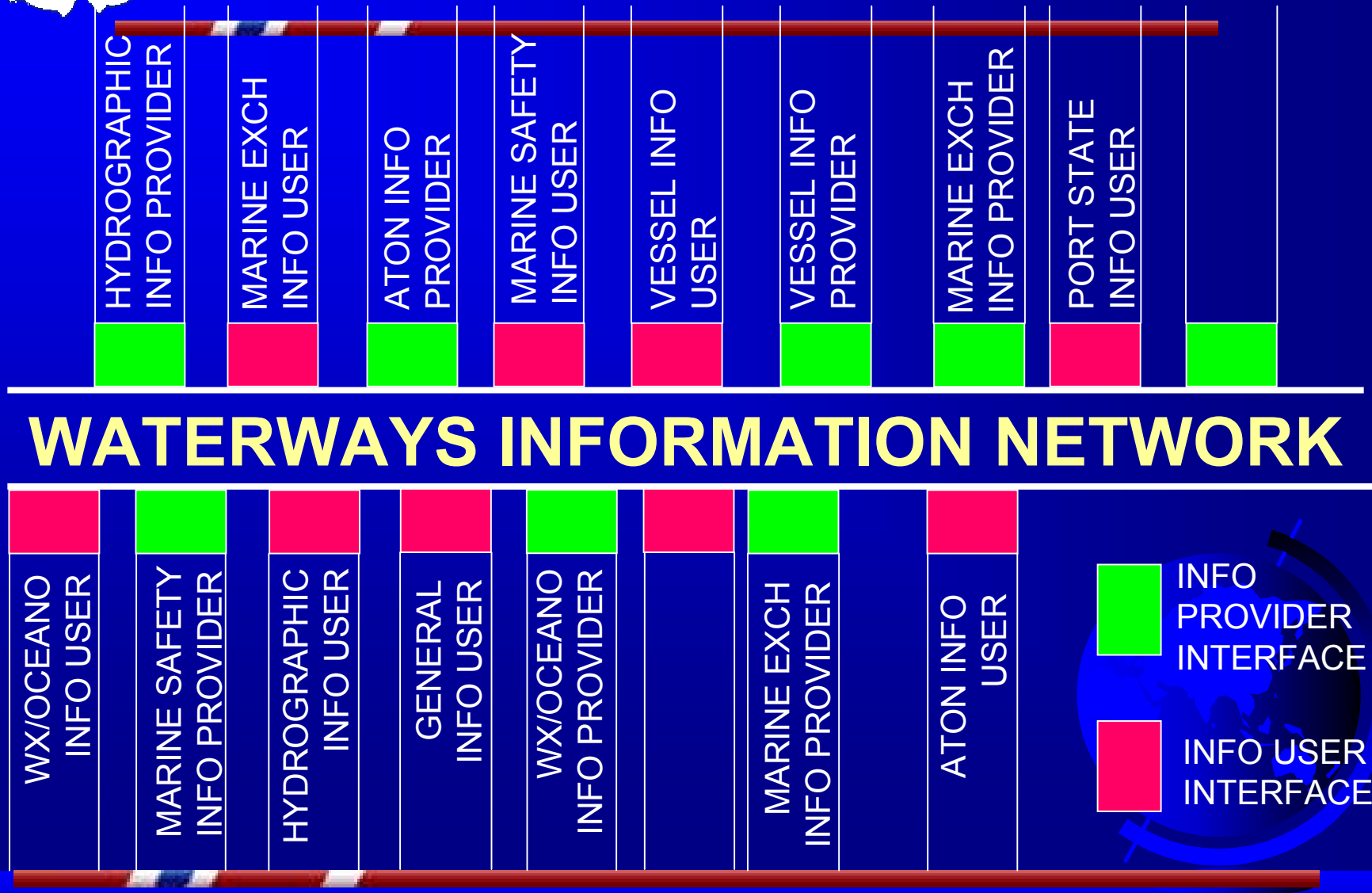
Network Solution



Network Solution

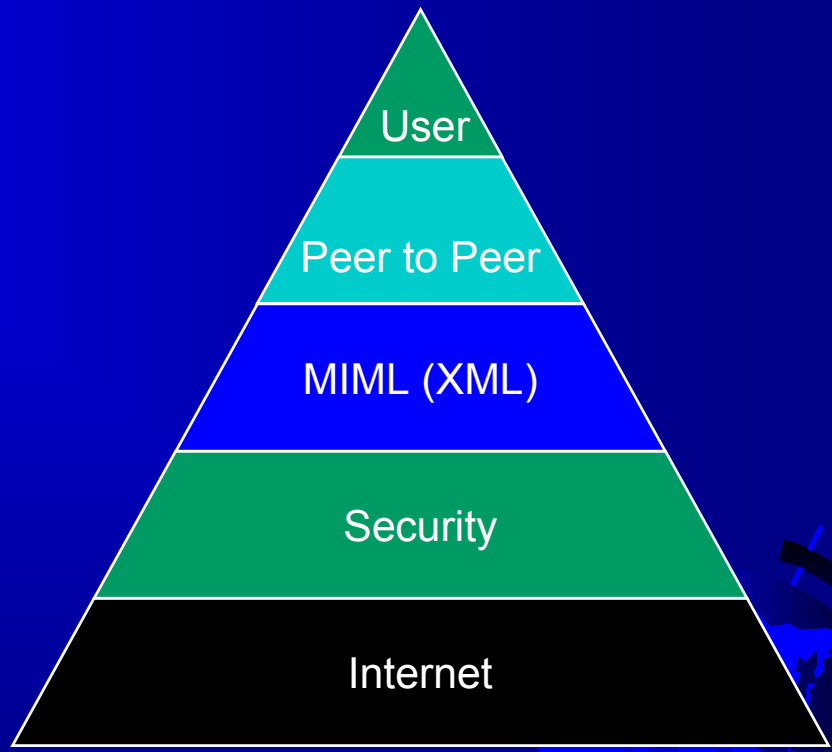


Network Solution



Waterways Information Network Concept

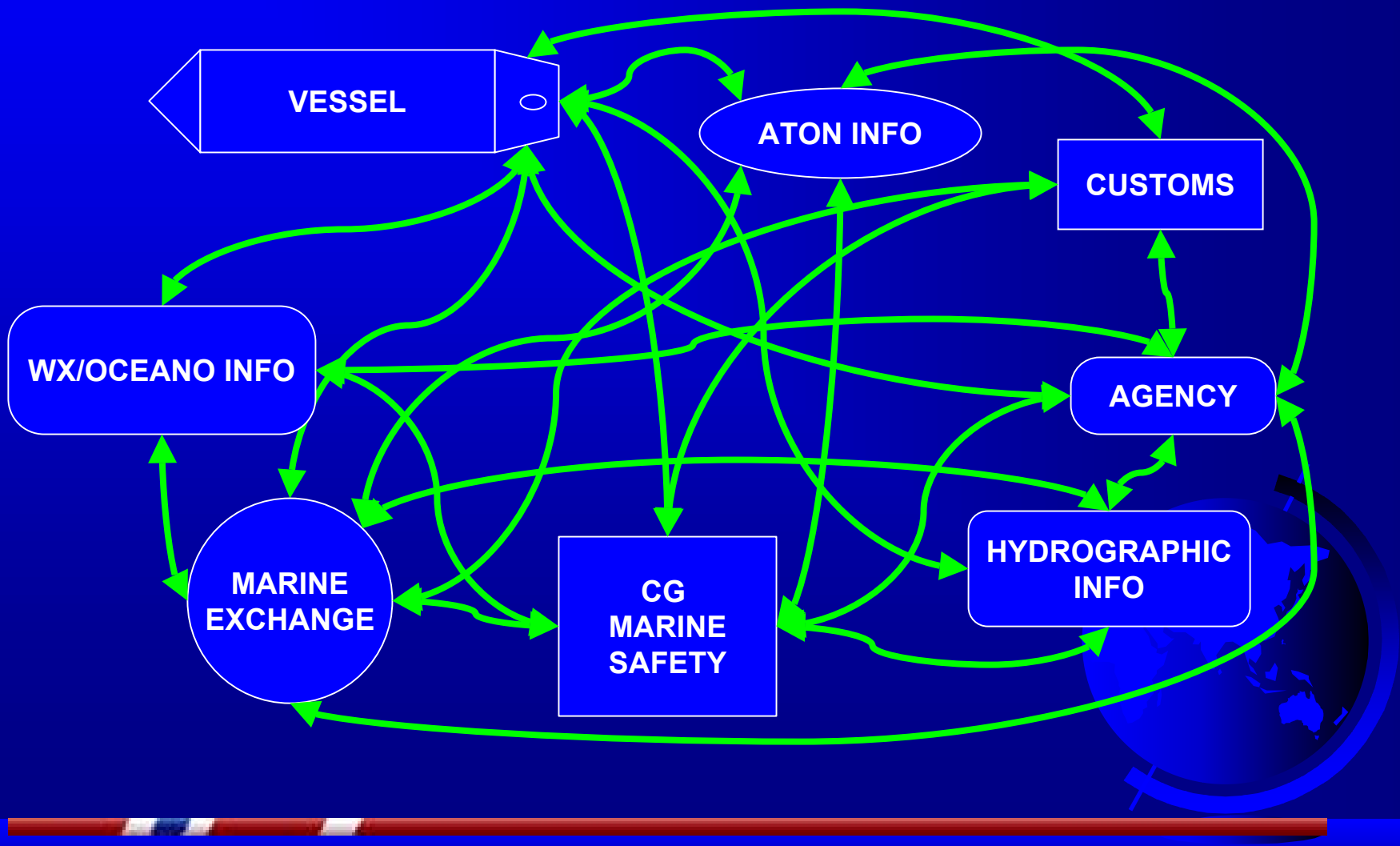
- WIN meets these needs through the use of a peer to peer network structure
- Data is formatted in XML to create the Maritime Information Markup Language (MIML)
- Security is through existing encryption standards.



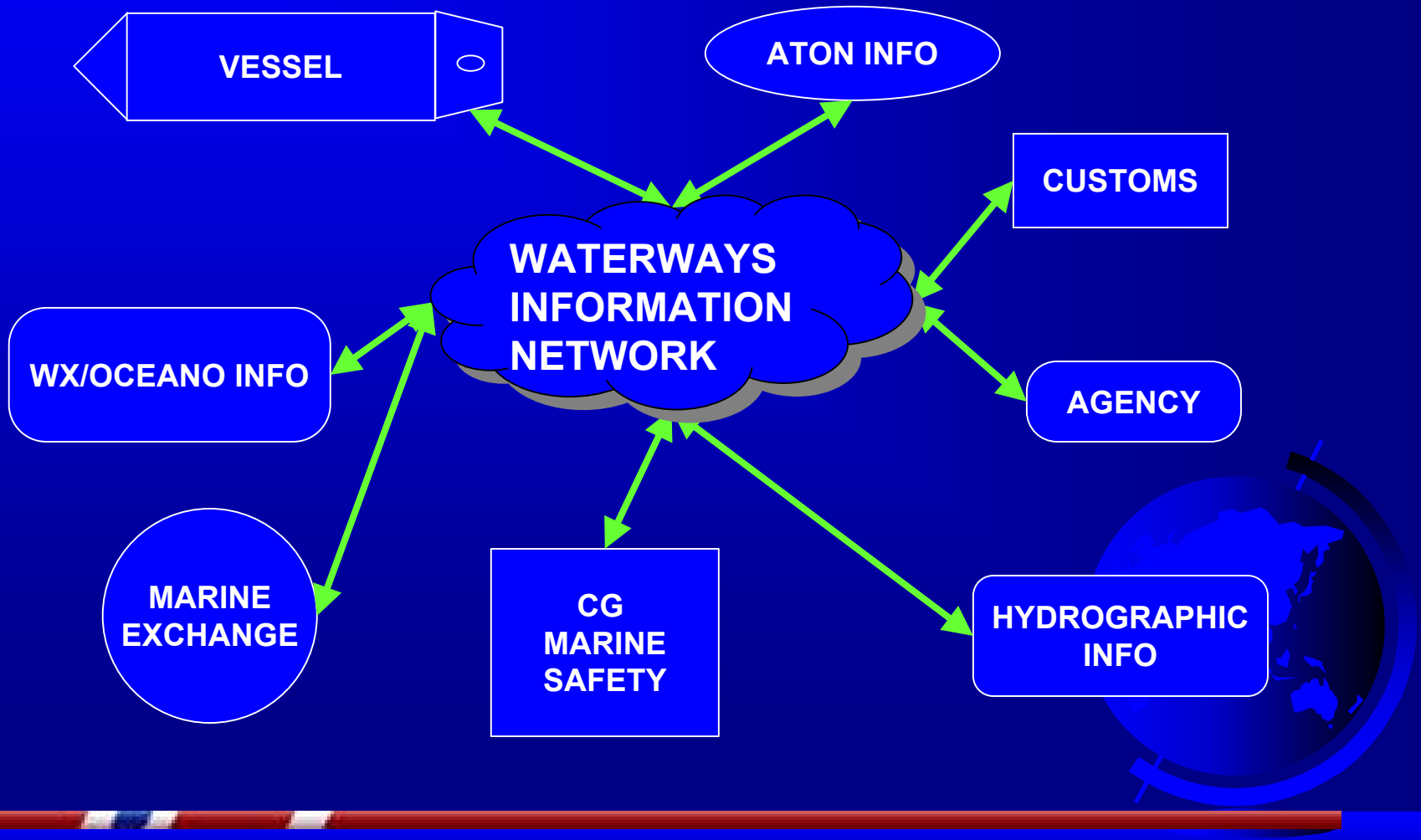
Why Peer to Peer?

- A type of network in which each workstation has equivalent capabilities and responsibilities. This differs from client/server architectures, in which some computers are dedicated to serving the others.
- Supports security & cost recovery
- Allows each individual to control access to the data they provide.

PEER TO PEER NETWORK



PEER TO PEER NETWORK



Arizona State University NSF effort

- Began in 2000
- Goal is to create a computational ontology that can facilitate effective sharing of maritime information.
- Initial data consists of electronic charts from NIMA, and NOAA and text files of the existing Coast Pilot from NOAA.

Computational Ontology

- **What is it?** A "representation of a conceptualisation". It is a collection of (defined) concepts that exist in a domain and the relationships between them. "Computational" means that it can be processed by software.
- The knowledge we need comes from standards documents; digital chart databases; lexicons and symbology definitions; and other `canonical' documents.
- Concepts and relationships are obtained by semi-automated scraping from various sources or by hand entry if the source is not sufficiently structured.

Computational Ontology

- **Why do we need it?** To allow software to 'understand' the relationships between things, for example, that a 'silo' is (for boaters) a 'landmark'.
- Reuse of other ontologies was explored early on, but it turned out that not much could be re-used, largely because the word senses were `wrong' for our domain. For example, a bridge is a passageway for cars...but a potential obstruction for boats.

Putting it all together

- Standards + chart database + lexicons + symbology definitions + sample documents ---> ontology
- Ontology (class and attribute names) ---> MIML tags
- MIML + {data retrieval, C P, weather information, etc.} ---> smarter applications, better information processing and sharing

Prototype

- ASU built a prototype application that accepts questions and provides answers in the form of information retrieved from several sources. It demonstrates the use of the taxonomy to provide a unified interface for retrieval of all types of information.
- It retrieves information from (1) the Coast Pilot; (2) a feature database generated from digital nautical charts; (3) web sites. It also generates some information (tide predictions) on an as-needed basis.
- Provide your email address and we will provide you with directions for accessing the prototype system on the web

MIML

- Customized XML schema
  - Supports interagency and public data exchange
  - Information categorization
  - Location based features (geocoded)
  - Time sensitive
  - Tiered approach to support different bandwidths

```
<?xml version="1.0"?>
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      <entry>
           <name>
        <first>Mark</first>
        <last>Whitteker</last>
      </name>
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        <street1>2817 Pinehurst Drive</street1>
        <street2/>
        <city>Raleigh</city>
        <state>NC</state>
        <zipcode>27604</zipcode>
      </address>
    </entry>
    <entry>
         <name>
        <first>Jack</first>
        <last>Frost</last>
      </name>
      <address>
        <street1>1 Cold Place</street1>
        <street2>Appt. 2B</street2>
        <city>Great Falls</city>
        <state>MT</state>
        <zipcode>59405</zipcode>
      </address>
    </entry>
  </addressBook>
```

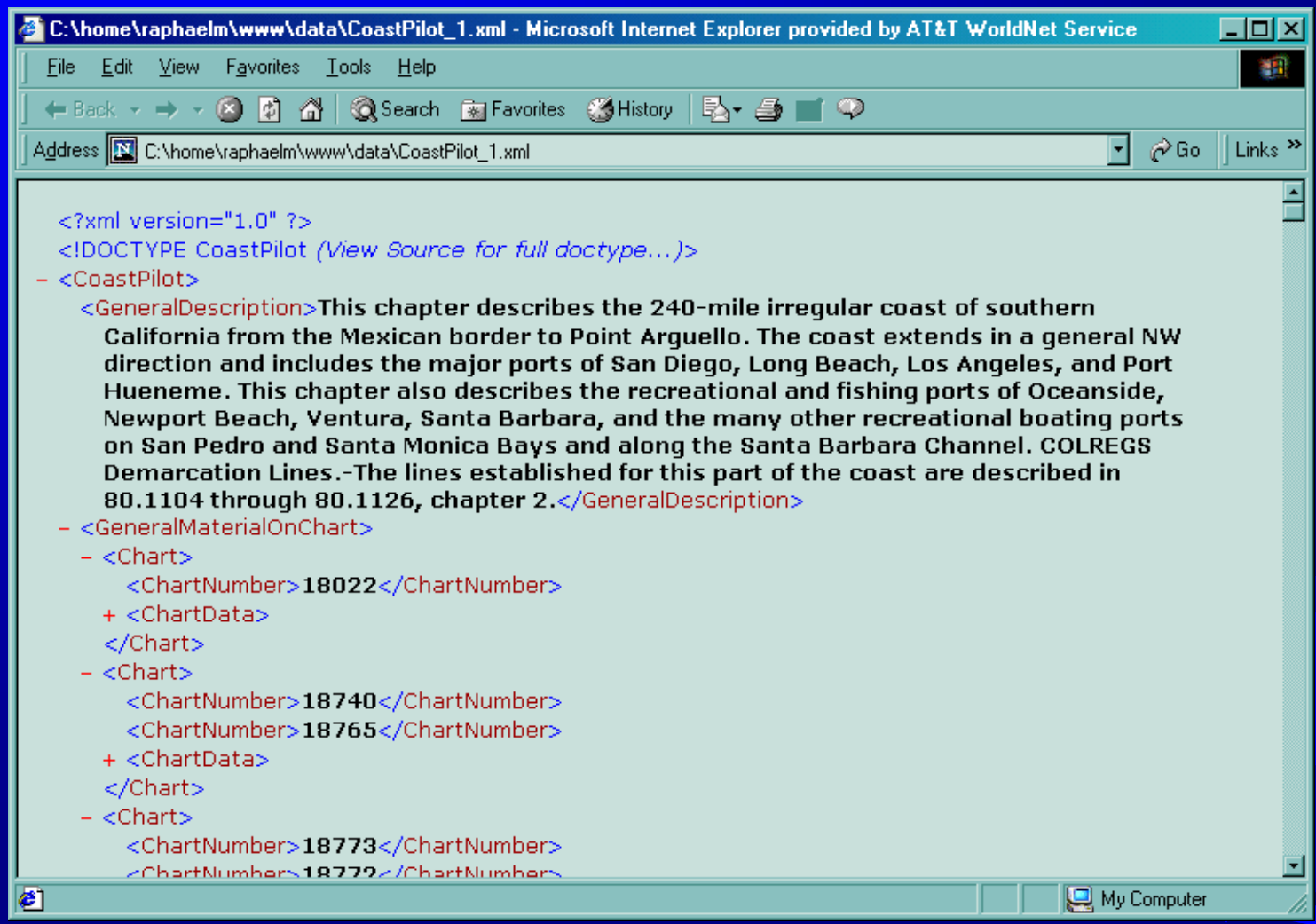
Major Maritime Information Categories

- Oceanographic & Meteorological Information
- Vessel Status Information
- Port Infrastructure & Services Information
- Navigation Safety Information
- Ship Safety & Reliability Information
- Recreational Boating Information
- Commercial Fleet, Passenger, Cargo Tracking & Mgmt
- Port & Waterways Planning & Mgmt
- Port Emergency Response Plans

MIML Development

- Form MIML working group (consortium)
  - Promote and encourage participation
  - Organize meetings
  - Coordination and collaboration
- Develop and maintain the documentation

MIML example



Some Links

- XML:
  - http://www.xml.com
  - http://www.xml.org
  - http://www.xml.gov
  - http://www.w3c.org/xml
- P2P:
  - http://www.peer-to-peerwg.org
  - http://www.exocortex.org/p2p
  - http://www.gnutellanews.com/

WIN Benefits

- Distributed nature of the P2P network is robust.
- Potential for rapid implementation.
  - Builds on industry standards.
- Costs of content development and network operation are distributed proportionately amongst various information providers.
- Participants automatically have “buy-in” & incentive to provide information.

Focus Group

- Meeting to discuss interagency interest and participation in the development of WIN

- Room 250 at 12:30 tomorrow
- November 15.